1907MNRAS..67..447R

(Iota).	Log plus F.	Δ_1	Δ_2	Log minus F.	Δ_1	Δ_2
69°	0·0108718		+45	9·9846255		−65
		+3150			−4500	
70	111868		42	41755		65
		3192			4565	
71	115060		44	37190		64
		3236			4629	
72	118296		43	32561		65
		3279			4694	
73	121575		44	27867		65
		3323			4759	
74	124898		43	23108		64
		3366			4823	
75	128264		42	18285		66
		3408			4889	
76	131672		43	13396		63
		3451			4952	
77	135123		43	08444		64
		3494			5016	
78	138617		42	9·99803428		65
		3536			5081	
79	142153		42	9·99798347		64
		3578			5145	
80	145731		43	93202		64
		3621			5209	
81	149352		41	87993		64
		3662			5273	
82	153014		42	82720		63
		3704			5336	
83	156718		42	77384		64
		3746			5400	
84	160464		41	71984		64
		3787			5464	
85	164251		42	66520		62
		3829			5526	
86	168080		40	60994		64
		3869			5590	
87	171949		40	55404		62
		3909			5652	
88	175858		42	49752		64
		3951			5716	
89	179809		+40	44036		−62
		+3991			−5778	
90	0·0183800			9·9738258		

Description of the 30-inch Photographic Reflector of the Helwân Observatory. By J. H. Reynolds.

There has recently been added to the equipment of the Khedivial Observatory at Helwân, near Cairo, a photographic equatorial reflector of 30-inch aperture: before giving a description of this instrument, a little explanation as to its origin would not be out of place. About five years ago one of the 30-inch Mirrors of Standard Astrographic focal length, which were ground and figured by the late Dr Common, came into my hands. I originally purposed to employ the mirror for nebular photography in this country, and commenced designing a suitable mounting. A visit to Egypt in

1907MNRAS..67..447R

1902, however, impressed on me the great advantages of a good climate for such work, and in January 1904 I went out again with the object of seeing if any arrangements could be made for setting the instrument up in Egypt and for working it.

I found an equatorial house and dome of 35 feet diameter had been erected on the hills above Helwân, about 12 miles south of Cairo: this dome was originally intended for the old 8-inch equatorial refractor, but it was much larger than was necessary for this instrument, and has proved of suitable size for the 30-inch Reflector.

The Director-General of the Survey Department, Captain H. G. Lyons, R.E., D.Sc., F.R.S., agreed, on behalf of the Egyptian Government, to accept the instrument for the Khedivial Observatory under certain conditions as to its employment, etc., and I have to express my thanks to him for the great assistance he has rendered in bringing the project to a successful issue.

The design of the mounting was commenced in June 1904, and the heavy parts were shipped and erected in the autumn of 1905. It was not until the beginning of this year, however, that photographic work was commenced, and the capabilities of the instrument tested.

The angle block carrying the polar axis is supported on a cast-iron base 7 feet high, which is in two sections, and rests on a concrete pier having a foundation of limestone. To this pier the base is securely attached by means of holding-down bolts.

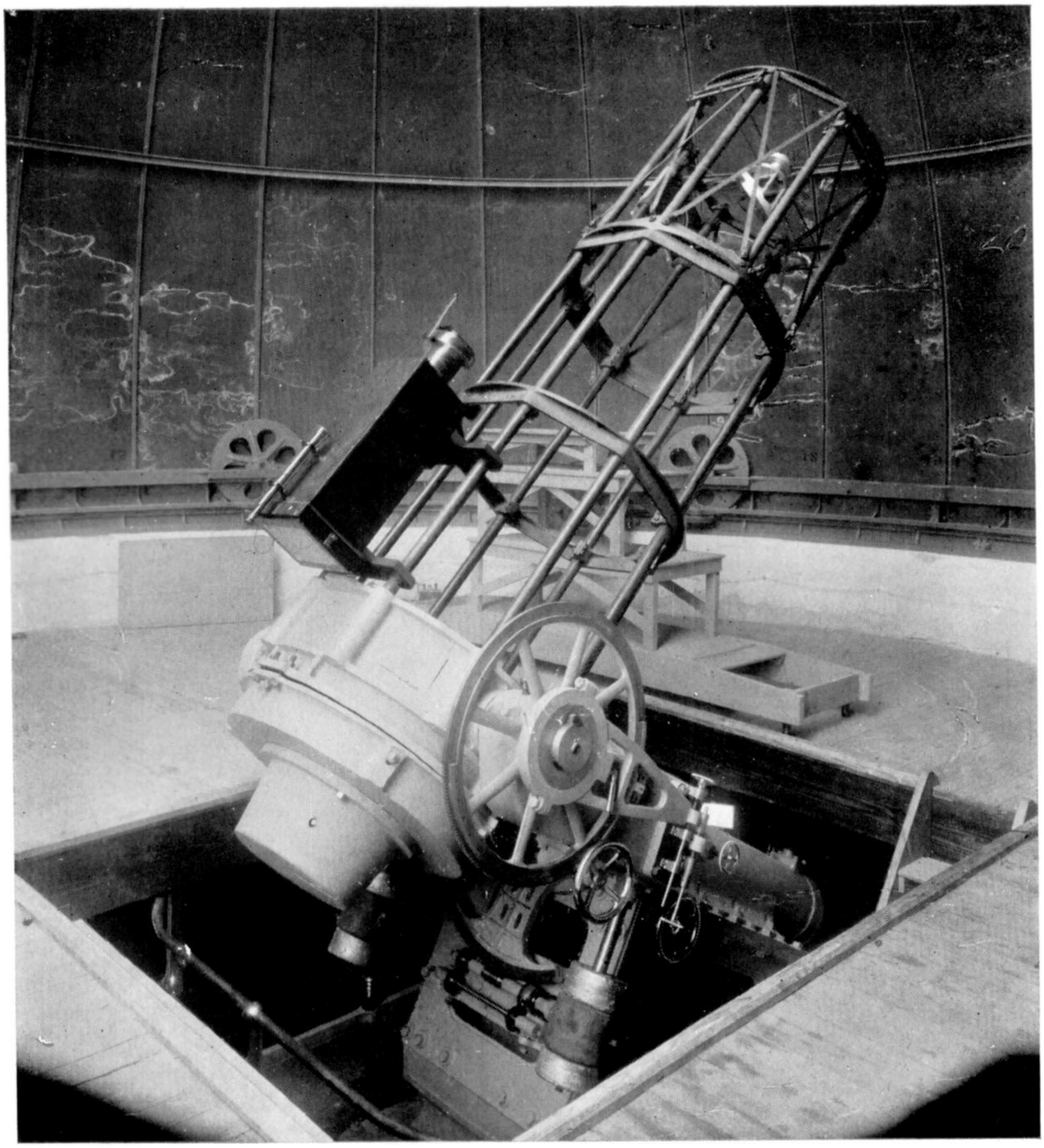
Round the top of the base runs a steel gallery giving access to the driving and setting mechanism. For the convenience of the operator all the motions and clamps are on the west side of the mounting, so that the setting of the telescope can be done completely from one position.

The angle block is provided with adjusting screws in azimuth and latitude, and contains the driving clock.

The polar axis, which is 6 feet long, is of mild steel and tapers from 6 inches diameter at the top to 5 inches at the lower end. It is held in position by two solid bronze bearings mounted in a cast-iron sleeve: two rings of 1-inch ball-bearings at the upper end of the sleeve and four rings at the lower end are so adjusted as to take the transverse and longitudinal thrusts on the polar axis. This manner of reducing the friction is very efficient, and the motion of the axis, which carries almost two tons, leaves nothing to be desired.

Attached by means of a flange to the upper end of the polar axis is the hollow cast-iron fork which carries the telescope, which has been made of considerable strength to prevent flexure. Some difficulty was experienced in designing this part of the mounting, as it was found that if the declination axis was placed in the same plane as the polar axis, the telescope could not be utilised far enough to the south, owing to the low latitude. It was ultimately decided to raise the declination axis vertically so as to allow of the telescope reaching to 40° south declination, the overbalancing east and west of the meridian which would result being counterbalanced

1907MNRAS..67..447R



THE 30-INCH REFLECTOR OF THE HELWÂN OBSERVATORY.

1907MNRAS..67..447R

by weights at the back of the fork. The further south one gets, the more pronounced this difficulty becomes, and I do not think it would be possible to employ the open-fork type of mounting at any lower latitude in consequence.

The telescope itself consists of an octagonal cast-iron base to which the mirror cell is bolted, and a light framework tube of seamless steel tubes and aluminium rings, similar to that of the 24-inch Reflector of the Yerkes Observatory: the cell and mirror supports were constructed by the late Dr Common, and have been added to the telescope without alteration.

The flat mounting is of aluminium, to lighten the upper end of the telescope as far as possible, and this, with the photographic and optical apparatus, is contained in a separate section.

The following is done by means of a positive eyepiece with electrically-illuminated double cross wires, placed as near the photographic dark slide as possible: the double stage, with screw motions in two directions at right angles to each other, is identical in arrangement with that originated and described by Dr Common. The driving clock is provided with maintaining gear and has frictional governors of the cross-armed American type: the winding gear and starting screw are both accessible from the west side of the gallery. The driving arc runs for four hours continuously and can quickly be brought back to the starting position: differential gear for lunar rate is also provided.

In actual working this method of mounting a reflector is found to be convenient, and the clock drives at a uniform rate. There are of course one or two small defects still to be remedied, as we have only been able to work the instrument for a week or so, but we have sufficiently tested it to know that when it is in thorough working order there is no reason why satisfactory results should not be achieved.

The erection of the instrument at the Helwân Observatory was done under the superintendence of Mr B. F. E. Keeling of the Survey Department, and has been accomplished, in spite of many difficulties, in a most admirable manner. Mr Keeling is also responsible for adapting the equatorial house to the requirements of a reflector, and a false floor has been erected round the instrument near the level of the sill plate of the dome. An adjustable observing platform has also been constructed, which has proved to be very suitable for reaching the eyepiece in all positions.

The work primarily to be undertaken with the instrument is nebular photography, especially of the region lying between the equator and 40° south declination. This region includes many interesting objects which, I think, have not yet been photographed with the light grasp of such an instrument. It is intended to add a finder of good aperture, so that it may be employed on cometary photography: one piece of work which would be very suited to its capabilities is a search for Halley's Comet, as was recently suggested by Mr Crommelin.

The climate of Egypt is very suitable for astronomical photography during the greater part of the year: at times the atmosphere is so clear that stars are seen to set suddenly behind the desert horizon, and from results already obtained we know the air is extraordinarily transparent to actinic rays. Optically the mirrors are of very fair figure, especially considering that the large parabolic mirror lay in a packing-case for several years; and I am glad to have been able to mount one of Dr Common's mirrors in such a favourable situation. As far as I am aware, the Crossley Reflector of the Lick Observatory is the only reflector in similar latitudes, and almost all of this instrument was Dr Common's work.

In conclusion, I should like to thank Professor Turner for the kind encouragement and advice he has given in what was to me a rather unaccustomed task, and also Mr E. I. Jenkins for his assistance with the design.

REFERENCES TO FIGURE. (Plate 2.)

A. Concrete pier built up on limestone foundation with well for clock-weight 5 feet deep.

B¹ B². Cast-iron base 7 feet high attached by means of holding-down bolts to concrete pier. The openings are filled in with plate glass, and a steel door on the south side of B¹ gives access to the interior of the base. B³ is bolted down to B², and has adjusting screws for latitude and azimuth.

CC. Steel gallery supported on cast iron brackets attached to B².

D. Angle block made in four sections bolted together, having large openings on all sides except the south, for easy access to the driving clock. The clock-winding gear is attached to the west side of D, which also carries the hand wheel and gear for the R.A. quick motion.

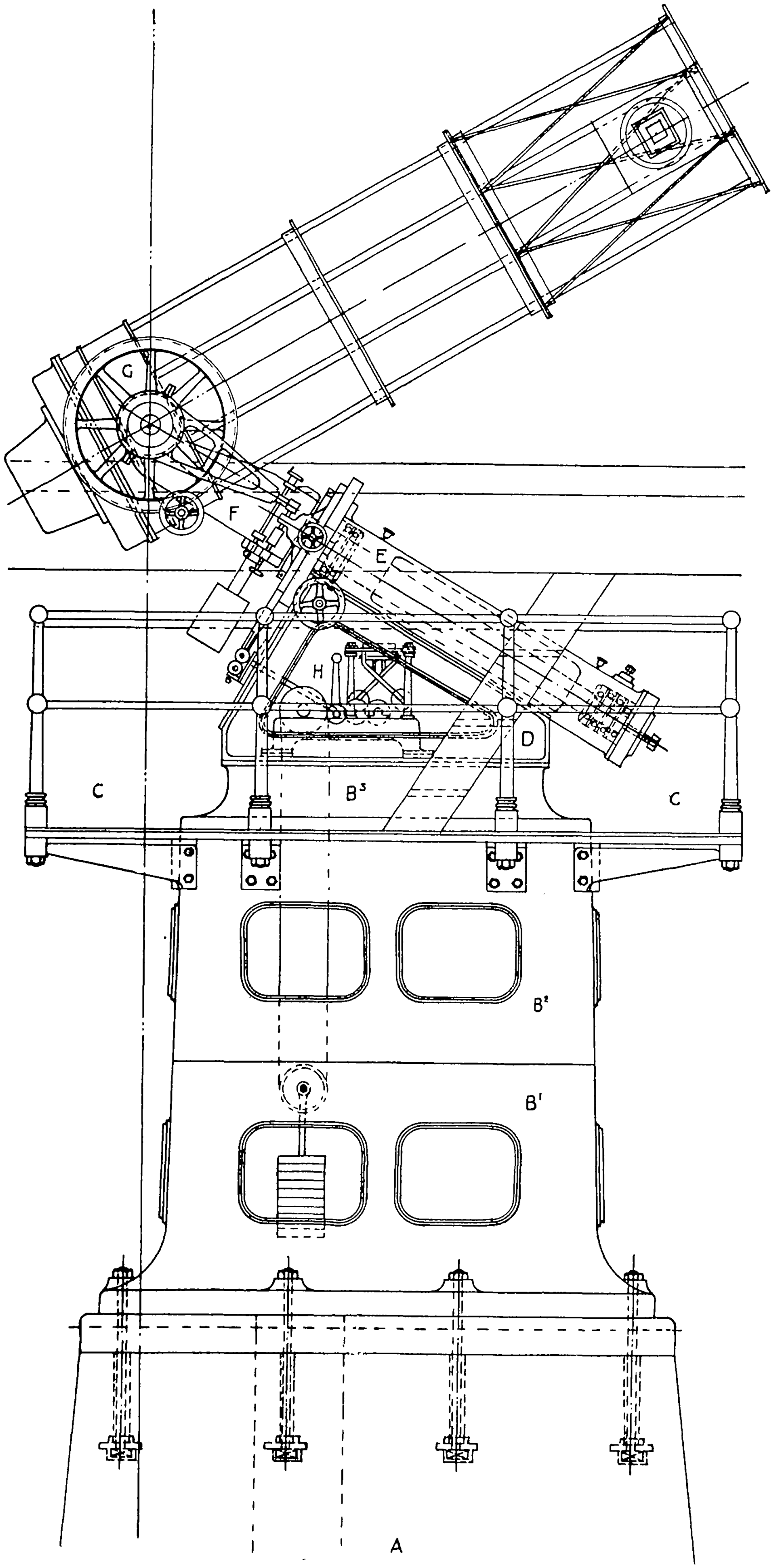
E. Heavy cast-iron sleeve bolted to D with solid bronze bearings and six ball-bearing rings, by means of which the weight of the polar axis, etc., is taken off the solid bearings. To the top of E is attached a flang plate for the R.A. adjustable vernier. The R.A. circle ring is bolted to a cast-iron plate keyed on to the polar axis: a rack is cut on the interior of this ring for the R.A. quick-motion pinion. The driving sector runs loose on the polar axis, and is cut with teeth 10 to the inch: on the top of the sector is a V-shaped wheel, to which the R.A. slow-motion arm is clamped.

F. Hollow cast-iron fork in which the telescope is suspended on trunnions: a plate on the west side holds the bearings for the slow-motion screws which pass through nuts let into the slow-motion arms: a double Hook's joint carries the motion of the R.A. clamp and treminates in a wheel.

G. Octagonal cast iron base of telescope tube: the trunnions are of steel bolted on to G. The west trunnion carries the declination circle: a pinion and hand wheel fixed on to the back of F give the declination quick motion. The mirror cell is bolted on to G, and is provided with adjusting screws: at the back of the cell is a counterpoise box filled with lead.

H. Driving clock: the frictional governors revolve on ball bearings, and the friction comes into play horizontally on a ring of polished tool steel.

1907MNRAS..67..447R



ELEVATION OF 30-INCH REFLECTOR.